SUB-MICRON LONG HTS HOT-ELECTRON MIXERS

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The hot-electron bolometer mixer made from a high-T_c superconductor (HTS) was introduced recently as an alternative to a Schottky mixer at THz frequencies. The performance of the mixer depends on the total thermal conductance for heat removal from the phonon sub-system due to either length-dependent phonon diffusion or phonon escape to the substrate. We have measured both the length and temperature dependencies of the IF bandwidth of the mixers fabricated from 25-35 nm thick YBCO films on MgO and sapphire substrates. The films were grown by a laser deposition technique and electron-beam lithography was used to define bridge lengths down to 50 nm. Mixer measurements were done using signal frequencies in the range of 1-100 GHz. For 50 nm and 400 nm long devices on MgO, the 3-dB bandwidth was about 100 MHz. At temperatures below 60 K, the hot-electron plateau was clearly seen starting around 2-3 GHz. At temperatures above 70 K, the flux-flow effects begin to dominate and the IF bandwidth increases to 1-8 GHz, while the conversion efficiency drops by several dB. This temperature dependence of the IF bandwidth can account for previously reported unexpectedly high bandwidth of HTS mixers.

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Topic 4: Detectors and Mixers
Poster